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EXAMINER

GRAHAM, ANDREW R

ART UNIT	PAPER NUMBER
2644	

DATE MAILED: 07/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/869,605	HANSEN, KIM V.
	Examiner Andrew Graham	Art Unit 2644

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 02 December 2004.

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-6 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-6 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) Notice of References Cited (PTO-892)
 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
 Paper No(s)/Mail Date _____

4) Interview Summary (PTO-413)
 Paper No(s)/Mail Date. _____

5) Notice of Informal Patent Application (PTO-152)
 6) Other: _____

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under PCT Rule 17, which papers have been placed of record in the file. As this documents provide the necessary support for the priority date claimed for the present application, the rejections based on Jourjine, as noted by the applicant, no longer retain the necessary priority date and have accordingly been withdrawn herein.

Response to Arguments

2. Applicant's arguments filed 12/2/2004 have been fully considered but they are not persuasive, as is further detailed below.

On page 5, lines 7-17, the applicant has stated, "The fact that Strandberg was aware of the possibility of using microphones having different directional characteristics but did not include this in his independent component approach can be seen as an indication" and "Otherwise, Strandberg would have made use of this to gain further improvement". The examiner respectfully disagrees. The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned. They are part of the literature of the art, relevant for all they contain." In re Heck, 699 F.2d 1331, 1332-33, 216 USPQ 1038, 1039 (Fed. Cir. 1983) (quoting In re Lemelson, 397 F.2d 1006, 1009, 158 USPQ 275, 277 (CCPA 1968)). Please refer to MPEP 2123 for further detail. In the present case, Strandberg teaches, as noted by the

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applicant, that microphones with different directional characteristics are known in the art of desired and undesired speech signal processing techniques. Co-processing signals from such microphones is described as providing the result of canceling noise or unwanted signals relative to the desired sound signal. Regarding the sensors (18a-c) implemented in the system described Strandberg, no restriction nor requirement is placed on the directivity of the sensors. Accordingly, the teachings of Strandberg, when considered for all that is contained therein, discloses that sensors with different directional characteristics are known to be used in the art, and provides at least one advantage for their use therein. This response also applies to the applicant's remarks made on page 6, lines 7-18.

On page 5, lines 17-19, the applicant has stated, "The Killion patent would not be combined with the teachings of any of the Kellermann or the Strandberg patents as no adaptive filtering is proposed in Killion" and "The Killion approach is entirely different from the approaches of Kellermann and Strandberg". The examiner respectfully disagrees. The reference of Killion provides evidentiary support to the concept first denoted in Strandberg, that different microphones having different directional characteristics enable noise or unwanted signals to be cancelled relative to a desired sound signal. The system of Killion teaches at least one state wherein both of different directional types of microphones are utilized to provide an input signal to a user, which corresponds to the weighted sum processing disclosed in the system of Strandberg (col. 9, lines 12-22

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of Killion and col. 2, lines 10-15 of Strandberg). The notion that Strandberg processes input signals in a manner different than an adaptive or weighted array does not preclude the benefits provided by such a form of received input signal, again, as evidenced by the results of such processing denoted by Strandberg, as well as the fact that Strandberg places no such restriction on the input sensors.

On page 7, lines 1-4, the applicant has stated, "there is no disclosure in either Strandberg or Preves which could lead a person of ordinary skill towards a use of this to enhance the effects of a system adapted to process the signals by means of an independent component analysis". The examiner respectfully disagrees. As noted above, Strandberg teaches that microphones with different directional characteristics are known in the art of desired and undesired speech signal processing techniques. Co-processing signals from such microphones is described as providing the result of canceling noise or unwanted signals relative to the desired sound signal. Regarding the sensors (18a-c) implemented in the system described Strandberg, no restriction or requirement is placed on the directivity of the sensors. Accordingly, the teachings of Strandberg, when considered for all that is contained therein, discloses that sensors with different directional characteristics are known to be used in the art, and provides at least one advantage for their use therein. Similarly, the system of Preves discloses that directional inputs reduce the miscellaneous noise present within a room. This initial form of processing is not obviated by the signal processing of Strandberg,

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which, while not significantly affected by reverberation, is not taught at being entirely immune to reverberation. Accordingly, use of microphones with different directional characteristics would have at least cancelled reverberations or extraneous sound from known directions as implemented by directional microphones, while still enabling the signal processing taught by Strandberg to factor a merged wave field into independent components without significant affect of the reduced reverberation present in the signal from the input sources.

Claim Rejections - 35 USC § 112

3. The applicant's amendments made to Claims 1-4 and 6 in view of the previous rejection(s) under 35 U.S.C. 112 of said claims suffice to overcome the basis of said rejection(s). Accordingly, said rejections are hereby withdrawn.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 1-4 and 6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Strandberg (USPN 6023514) in view of Kellermann

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(USPN 5602962) and Killion et al (USPN 5524056). Hereafter, "Killion et al" will be referred to as "Killion".

Strandberg discloses a system for isolating the independent components of a merged audio field. Hearing aids are disclosed as one such system wherein such isolation of different audio sources is desirable (col. 1, lines 27-52 and col. 4, lines 55-61). The system is discussed in terms of a target source (16b) in the context of two other sources (16a,16c) (col. 5, lines 30-41). One or more of the factored signals (38a-38c), which correspond to the signals (14a-14c) from the sources (16a-16c), may be selectively transmitted to a user (col. 7, lines 44-49). This selective further processing, in the context of a target source, reads on "A device for use in reducing noise in an audio signal containing noise and a target signal" and "removing at least part of the unwanted signal elements, thereby enhancing other parts of the audio signal". The exemplary embodiment of Strandberg shows three sensors, but it is noted that two may be used (col. 5, lines 1-2 and 58-67 and col. 6, lines 1-2). This reads on "at least two channels each receiving a signal from a respective microphone". The input signals are then digitized and applied to a digital signal processor (col. 6, lines 24-51). This equates to "signal processing means in connection with the input channels". In the context of a hearing aid device, the "transmitted to the user" would inherently involve some form of acoustic output device, which equates to "a receiver in connection with the digital processing means" (col. 7, lines 47-49). The individual components the form the

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merged acoustic field are based on cross-correlation, wherein the maximum element in the cross-correlation array is used to calculate the original source signal (col. 9, lines 7-58). This processing is executed by the digital signal processor (20). This isolation of independent components based on finding a maximum cross-correlation reads on "adapted to process the signals by means of an independent component analysis" and "determining whether statistical dependent signal elements are present".

However, Strandberg does not specify:

- that the processing involves differences of signal to noise ratios of the inputs signals in relation to a desired target signal

Kellermann discloses a system for processing an input comprising both speech and noise components. Input for the system is provided through the use of N microphones, which are connected to N inputs of a preprocessor unit (2) (col. 3, lines 3-19). The signals are also applied to controllable multipliers (3), wherein the control signal for the multipliers is obtained from an evaluation unit (4) in response to the input signals (col. 3, lines 25-31). The control signals are based on the ratio of the speech component in each signal to the power of the noise component, which corresponds to the signal to noise ratio (col. 2, lines 1-3 and col. 4, lines 10-49). The produced effect of such processing is an improved overall signal to noise ratio of the output signal and thereby an improved speech audibility (col. 5, lines 24-29). This formation of a control signal

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or weighting factor, reads on "based on differences of signal-to-noise ratios of the input signals in relation to a desired target signal".

To one of ordinary skill in the art at the time the invention was made, it would have been obvious to include the input weighting scheme of Kellerman as part of the signal processing in the system of Strandberg. The motivation behind such a modification would have been the improvement in the suppression of a noise or undesired component of a received audio signal. The scheme of Kellermann also incorporates the efficient computation of weighting factors in real-time, which would have been desirable for implementation in an alternate system, such as a hearing aid.

However, Strandberg in view of Kellermann does not specify:

- that the two microphones of the system have mutually different directionality

Killion discloses a hearing aid with at least two microphones, and a processing scheme that reduces the SNR of the produced output signal (col. 6, lines 21-43). One embodiment involves the use of an omnidirectional microphone (15) and a directional microphone (20), while another embodiment involves the use of two directional microphones (col. 5, lines 15-21 and col. 6, lines 37-48). Both systems involve a switch (55) which alternately connects the microphone signals to the output of the system (col. 6, lines 22-30 and 63-64). Figures 18 and 19 illustrate the sound ports (400,400',415,415',440) associated with a pair of first order directional microphones (445,450) and an omnidirectional microphone

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(col. 11, lines 35). Figure 19 particularly shows diffraction scoops (480) for increasing effective spacing and directional sensitivity of the microphones (col. 11, lines 46-56). Collectively, these teachings and the combination of various directional and non-directional microphones, reads on "at least two of the microphones having mutually different directionality". The system of Killion is also noted to include a speaker, which also reads on "a receiver in connection with the signal processing means" (col. 11, lines 13-16).

To one of ordinary skill in the art at the time the invention was made, it would have been obvious to include microphones of different directionalities as taught by Killion in the hearing aid system of Strandberg in view of Kellermann. The motivation behind such a modification would have been that such microphones would have enabled different pickup sound fields to be provided as inputs to the processing system, which would have improved the SNR ratio of an input signal in regards to an input source with a predetermined directionality. Strandberg notes that microphones with such different directionalities have been known to be used in noise canceling systems.

Regarding **Claim 2**, the embodiment of Figure 13 includes an omnidirectional microphone (230), a first order directional microphone (235), and a second order directional microphone (240) (col. 9, lines 46-49). This reads on "the device comprises at least a directional microphone and an omnidirectional microphone".

Regarding **Claim 3**, Figure 1 illustrates a SDPT switch (55) which exclusively connects either of the two microphones (15,20) to the hearing aid amplifier (60) (col. 6, lines 22-35). The embodiment of Figure 13 illustrates the use of FET switches (255,260,275) connected to amplifiers (280,285) such that different levels of noise conditions enable the inputs of different microphones to dominate the output signal (col. 9, lines 51-67). These two switching arrangements read on "means are provided for switching between the two or more output signals or combinations of these".

Regarding **Claim 4**, the embodiment of Figure 13 illustrates the use of FET switches (255,260,275) connected to amplifiers (280,285) such that different levels of noise conditions enable the inputs of different microphones to dominate the output signal (col. 9, lines 51-67). The operation of the amplifiers (280,285) and switches (255,260,275) is based directly on a rectified (270) copy of the input signal from the omnidirectional microphone (230) (col. 9, lines 54-56). This reads on "two or more output signals are produced and where automatic switching means are provided for switching between the two or more output signals according to a predetermined scheme".

Regarding **Claim 6**, please refer above to the components cited in the rejection of Claim 1, noting particularly the amplifier (60) and microphones with different directionalities of the teachings of Killion.

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4. **Claim 5** is rejected under 35 U.S.C. 103(a) as being unpatentable over Strandberg in view of Kellermann and Preves et al (USPN 5757933). Hereafter, "Preves et al" will be referred to as "Preves".

Strandberg discloses a system for isolating the independent components of a merged audio field. Hearing aids are disclosed as one such system wherein such isolation of different audio sources is desirable (col. 1, lines 27-52 and col. 4, lines 55-61). The system is discussed in terms of a target source (16b) in the context of two other sources (16a,16c) (col. 5, lines 30-41). One or more of the factored signals (38a-38c), which correspond to the signals (14a-14c) from the sources (16a-16c), may be selectively transmitted to a user (col. 7, lines 44-49). This selective further processing, in the context of a target source, reads on "A device for use in reducing noise in an audio signal containing noise and a target signal" and "removing at least part of the unwanted signal elements, thereby enhancing other parts of the audio signal". The exemplary embodiment of Strandberg shows three sensors, but it is noted that two may be used (col. 5, lines 1-2 and 58-67 and col. 6, lines 1-2). This reads on "at least two microphones". The input signals are then digitized and applied to a digital signal processor (col. 6, lines 24-51). This equates to "signal processing means in connection with the input channels". In the context of a hearing aid device, the "transmitted to the user" would inherently involve some form of acoustic output device, which equates to "a receiver in connection with the digital

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processing means" (col. 7, lines 47-49). The individual components of the form the merged acoustic field are based on cross-correlation, wherein the maximum element in the cross-correlation array is used to calculate the original source signal (col. 9, lines 7-58). This processing is executed by the digital signal processor (20). This isolation of independent components based on finding a maximum cross-correlation reads on "adapted to process the signals by means of an independent component analysis" and "determining whether statistical dependent signal elements are present".

However, Strandberg does not specify:

- that the processing involves differences of signal to noise ratios of the inputs signals in relation to a desired target signal

Kellermann discloses a system for processing an input comprising both speech and noise components. Input for the system is provided through the use of N microphones, which are connected to N inputs of a preprocessor unit (2) (col. 3, lines 3-19). The signals are also applied to controllable multipliers (3), wherein the control signal for the multipliers is obtained from an evaluation unit (4) in response to the input signals (col. 3, lines 25-31). The control signals are based on the ratio of the speech component in each signal to the power of the noise component, which corresponds to the signal to noise ratios (col. 2, lines 1-3 and col. 4, lines 10-49). The produced effect of such processing is an improved overall signal to noise ratio of the output signal and thereby an improved speech

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audibility (col. 5, lines 24-29). This formation of a control signal or weighting factor, reads on "based on differences of signal-to-noise ratios of the input signals in relation to a desired target signal".

To one of ordinary skill in the art at the time the invention was made, it would have been obvious to include the input weighting scheme of Kellermann as part of the signal processing in the system of Strandberg. The motivation behind such a modification would have been the improvement in the suppression of a noise or undesired component of a received audio signal. The scheme of Kellermann also incorporates the efficient computation of weighting factors in real-time, which would have been desirable for implementation in an alternate system, such as a hearing aid.

However, Strandberg in view of Kellermann does not specify:

- that the at least two microphone means include beamforming means to make beamforming of the input signals from the microphones and hereby adding directionality to the signal of the signal of at lease one of at least two input channels

Preves discloses a system that utilizes two microphones (B,F) and various components to shape the received sound field of the combined microphones (col. 4, lines 48-55). Switching means (S1) determine if the processed signal includes the non-directional input from just one of these microphones, or a processed, directional combination of these two microphones (col. 4, lines 61-67 and col. 5, lines 1-3). The second microphone (B) signal is passed through an inverter (52), an adjustable phase delay (54), and an adjustable gain (56), such that

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the user may vary the polar directivity pattern of the pickup of the hearing aid (col. 5, lines 14-26). The switch and these processing components read on "beamforming means to make a beamforming of the input signals from the microphones and hereby adding directionality to the signal of at least one of at least two input channels".

To one of ordinary skill in the art at the time the invention was made, it would have been obvious to include the switch and other components of the system of Preves as part of the microphone pickup of the system of Strandberg in view of Kellermann. The motivation behind such a modification would have been that such circuitry would have enabled a polar directivity pattern of the input to be varied from non-directional to super cardioid. As taught by Preves, directional signal pickup reduces miscellaneous sound present in the received signal, which is echoed in the disclosure of Strandberg.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew Graham whose telephone number is 571-272-7517. The examiner can normally be reached on Monday-Friday, 8:30 AM to 5:00 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vivian Chin can be reached on 571-272-7848. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Andrew Graham
Examiner
A.U. 2644

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July 11, 2005



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